Giselle™
TURN-KEY LAND ADMINISTRATION SUITE

SINERGISE

More than ever, land administration systems are needed to help secure property rights, in particular efficient land markets and effective land use management and for those who have traditionally been disadvantaged.

Sinergise is very experienced in developing and operating **Land Administration systems**. These serve complex requirements, especially in the areas of defining and documenting robust registers of legal persons, physical objects (land and buildings) and their values. Everything is based on modern and efficient technologies, including a Service Oriented Architecture (SOA), conforming to the latest international standards and principles.

1. EXECUTIVE SUMMARY

The challenges of modern land administration systems are presented in the roles of land administration in formalizing land markets, implementing and understanding regulations and restrictions, and changing the nature of ownership.

More than ever, land administration systems are needed to help secure property rights, in particular efficient land markets and effective land use management and for those who have traditionally been disadvantaged. No development will take place without spatial data, and no sustainable or equitable development will happen without the proper land governance to support it. Arguably, sound land governance is the key to achieving sustainable development, yet it is one which is driven with inefficiency and corruption, and good land administration systems must therefore be developed to be transparent, efficient and be a strong, reliable basis for supporting sustainable economic development.
Land administration systems must be highly integrated. The operations of the four core functions: land tenure, land valuation, land use and land development should be driven by a single sustainable land policy and underpinned by a spatial information infrastructure that provides the fundamental and authoritative spatial information sets.

The new Land Management Paradigm allows for the practical implementation of sustainable land policies: better land tenure and valuation systems should continue to generate economic wealth through land transfer and taxation; **better tenure systems should strengthen social cohesion through the provision of tenure security; finally, integrated land development and use systems should limit environmental degradation of land for the benefit of the wider community.**

LAND ADMINISTRATION BUSINESS DRIVERS

An effective Land Administration System therefore needs to be the foundation for both land governance and management in an effective, transparent and unified way. A well-implemented land administration system will result in:

- Increased efficiency, transparency and sustainability of land allocation.
- Enhanced land security through land registry improvement.
- Improved availability of land information for investors.
- Reduced time and cost of obtaining zoning and construction permits and improved regulation.
- Reduction of land transaction costs.

A fully-populated, functioning Land Information System (LIS) will also present the opportunity for:

- Better understanding of the residents.
- More respect for council systems and officers.
- A more professional approach to local revenue generation and collection.
- Better, more robust, trackable and well-monitored planning decisions, including better GPS, visualization and modelling of policy change.

2. LAND INFORMATION SYSTEM VISION

We propose a holistic Land Information Service, based on accepted international standards, that allows users of all relevant Ministries and Agencies to carry out their day-to-day business processes efficiently and effectively, in a digital manner, using common databases, with no duplication of effort or data.
This forms a vital part of the National Spatial Data Infrastructure (NSDI). The users' day-to-day business activity will automatically update all related databases without requiring frequent mass data capture and conversion. This will eventually present a complete, self-updating, efficient, transparent and accessible One-Stop Shop for all stakeholders, including the general public, irrespective of where they are and what language or alphabet they use.

Our Land Information System may be portrayed as shown in the diagram. User demands (from different users) are made through different devices and mediums to the Client Ministry service providers, who are supported by at least five inter-connected easy-to-use and accessible subsystems. These subsystems themselves are underpinned by a set of standards and principles and contain a range of effective tools and constant up-to-date data.

All modules are supported by operational:

- Help desk.
- Detailed documentation.
- Online help.
- Tutorial/training/refresher databases.
- Support and maintenance agreements.
- Hardware and software KPIs.
- Configuration control and roll-out.
- Source code documentation and repositories.

All subsystems/modules are:

- Easy to use.
- Accessible from anywhere, anytime, with appropriate user access control.
- Have the same look and feel.
- Able to use all technologies.
- Permit forward-capture using the latest techniques and tools (e.g. GPS, Android, etc).
- Permit back-capture to the same data model and flexibility.
- Online training and help.
- Some translation services (choice of language, alphabet character set, etc).
- Include reporting tools, on users, tasks, parcels, buildings, etc.

Non-technical Components

As well as including all these operational subsystems and elements, other Critical Success Factors for a LIS include:

- A clear definition of how management supports government policy.
- Clear and visible senior leadership.
- Full engagement and participation of all relevant and connected organizations.
- Inclusion of all major stakeholders in the collaborative decision making.
- Integration of the best practices and key performance indicators within the project.
- Willingness to implement change in a strategic and proactive manner.

The system must work with any existing topographic information, satellite data or aerial photography. Its data will facilitate effective reporting at local, regional and national scales, and be supported by excellent and thorough documentation. The system must facilitate swift and cost-effective land and property transactions with unambiguous tenures, thereby reducing litigation cases and costs.

We plan to clarify and improve these concepts and assumed organizational structures in more detail at the start of the project. This establishes the framework in which we can start our project-specific design and any needs assessment for training and additional assessment to make the expectations a reality.

Benefits

A fully-populated, functioning LIS will allow for:

- Better understanding of the stakeholders, including residents and land owners.
- More respect for council systems and officers.
- A more professional approach to local revenue generation and collection.
- Better, more robust, trackable and well-monitored planning decisions, including better GPS, visualization and modelling of policy change.

Most of all, it will show a professional and robust approach to managing assets (including land), which will attract investors and lead to improved chances for tenants' to find good employment as well as improved lifestyle opportunities.

Benefits for the staff:

- Advanced systems and tools.
- A more efficient way to perform duties, saving time and energy.
- Better training and confidence.
- A professional approach to customers and services.
- Portability of cross-department and cross-LGA skills.
- Efficient and transparent analyses of trading licenses and building permit applications, in relation to planning schemes and other restrictions.

Benefits for Country Residents (payers):

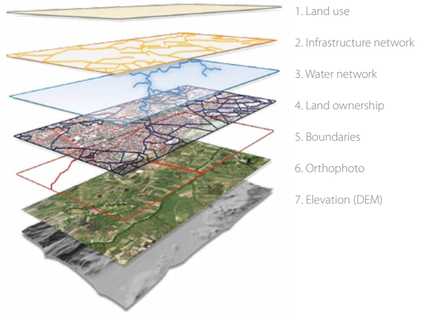
- Reliable ways of paying for services (e.g. by bank transfer, etc.).
- Dependable receipted transactions for all services.
- Efficient dealings with governments (local and national) and knowing the status of all correspondence and applications. (land purchase, rent, building permits, trading permits, etc.).

Benefits for Investors:

- Evidence of a well-run administration, with excellent planning, and reputation of reliable and efficient management of services and assets.
- Good management of land and infrastructural access to enterprise zones.
- Focus and assistance to exploit key beneficial products and services from the Administration.

Benefits for Mayors/ Directors/Administrators:

- Increased investment and economic improvements of the city/area.
- Wealthier administration, more local revenue → more services → more willingness to pay and develop the area.
- Higher local revenue for better service provision.
- More professional and effective approach of local Government staff.
- Better evidence base to make and monitor decisions on city development.



3. SOLUTION OVERVIEW

Sinergise offers a solution which is an easy to use, is platform-independent and utilizes graphical user interfaces and relational databases. Its fully web-enabled modular design and flexibility facilitate enhancements and integration with new or existing third party systems such as accounting.

The system captures data at the point of creation ensuring that the property and collection of data is consistent and conducive for better decision-making within the organization. The system allows the viewing of property tax data based on the roles to citizens, revenue inspectors and the decision makers - leading to transparency and efficiency in collections.

The system integrates with any existing tax system for validation and exchange of information, provides support for use of appropriate off-the-shelf tools such as ArcGIS, qGis etc., provides support for internet mapping, geo-processing, large scale databases and for GPS and client devices e.g., personal computers, laptops, tablets, and mobile devices. It is a holistic solution based on the latest internationally-recognized land models (LADM) as well as the emerging Social Tenure Domain Model.

Our system can be distributed across organizations in different parts of the country with multi-thread security protection. All systems have role-bases access, and additional security is provided through encryption and certification of generated documentation.

All of our solutions are based on Giselle – our framework for efficient spatial data management and editing on desktop or thin-client applications. It also provides for rapid in-field data capture using mobile devices. Equipped with GPS receivers, embedded digital cameras, along with the latest aerial photography and/or satellite images, the field staff can record such things as property extent, status and condition.

All field information and the digitized cadastre can be linked to scanned official documentation such as title deeds or certificates of ownership. The in-field applications assure rapid information flow, flexibility, accuracy and proper course of the process which greatly reduces the effort, time and number of errors.

The land administration suite consists of several modules, which are tightly integrated to ensure the quality of results and efficiency of the processes:

- **Data Collection** - tools for efficient collection of data, either remotely using aerial and/or satellite imagery, or in the field using mobile devices.
- **Case Management and Workflow** - we established a set of tools to support most common processes (Certificate of Occupancy, Land Survey, Leases, etc.) and can be configured to follow additional processes.
- **Register of Rights, Restrictions and Responsibilities** - advanced document management tool managing the relationship between objects (parcels, buildings, contracts, etc.) and the related people, legal entities, banks and governments.
- **Register of Parcels, Buildings and other Physical Objects** - spatial and alpha-numerical editing of objects, which are related to one another (e.g. a building is located on a specific parcel), requires advanced IT support, which takes care of data consistency.
- **Property Valuation and other Revenue Collection Sources** - once we have all relevant data about real properties and their locations in the system, we can use these to generate revenues for the client.
- **Urban Cadastre and Master Plan** - once the basic processes for land administration are covered, the governments, either local, regional or national, can introduce fact-based planning processes, ensuring proper urbanization of cities, development of rural areas, etc.
- **e-Government Services** - to ensure transparency, governments may decide to publish various data to the public, either free of charge or to payable customers.
- **Supportive land administration modules.**
- **Technical features**, which support all the above mentioned modules, such as spatial data infrastructure (SDI), reporting and printing tools, 3D terrain modeling and similar.
- **Administration tools** - behind-the-scenes tools, which support system administrators to ensure uninterrupted operation of the system, consistency of the data, updating of the external datasets, communication with end users, etc.

This collection of tools should support all processes necessary for land administration. In some cases one or several of these systems will already be present and we are able to integrate with them. Clients might also decide to start with just a few modules and then develop further on, once the processes are in place.

Ease of Use

The system should be usable by various users with different levels of technical expertise, most of which have little or no experience with GIS software. We therefore feel that it is very important that the user interface is as simple and intuitive as possible.

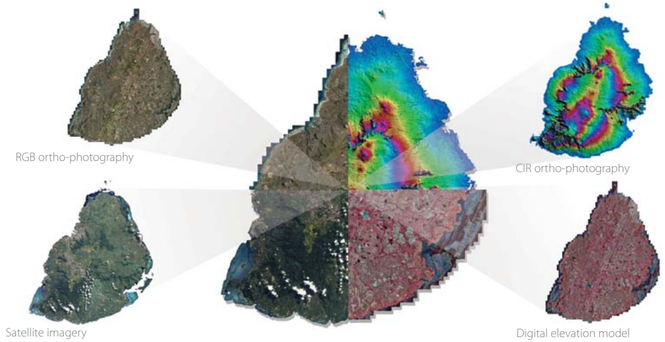
The following approaches encompass our philosophy in defining a friendly user experience:

- The client desktop application is started from a web browser and updated automatically when new versions, updates and patches are available.
- The solution is based on web technologies and the Java™ platform which allows the software to run on a variety of different platforms and operating systems.
- The user interface, including error messages, is parameterized and can easily be completely localized.
- Attribute forms use advanced constraints to check the data entered by users and guide them in case of omitted or erroneous entries (in the form of wizards).
- Graphical editing can be fully topological, preventing errors during editing and guiding the user through advanced editing tasks (creating holes, splitting, snapping), and errors (intersections, misplaced centroids, duplicate points …).
- Links to context-related HTML help pages are available in various parts of the user interface.
- Task-oriented user interfaces can assist even novice users going through steep learning curves.
- Features can be made available by user role and experience - more powerful features, although not explicitly visible in the user interface are accessible to advanced users and experts.
- Editing of attribute data is highly customizable and supports various data formats and different constraints such as predefined lists of values and regular expressions. Validity verification of attribute and spatial data is performed within the client application and detailed comprehensive reports of the verification are displayed to the user.

4. DATA COLLECTION

In many cases, land administration systems require considerable amounts of data capture or migration - which, because of its very nature, demands very high accuracy and faithful reproduction of the actual situation on the ground, or how it has been represented in previous documentation. Hence, we have built several systems and applications, which ensure efficient data management collection and, most importantly, ensure the highest quality of results;

- On-line desktop multi-user data collection and management system - based on the Cloud infrastructure, this will support centralized and harmonized management of data and digitization of data based on aerial and satellite imagery.
- Mobile based Field Data Collection system - based on Android OS, this system will connect to the data management system and support the allocation of tasks (packages) amongst surveyors, guided data entry and seamless transfer of data. On-entry data validation and post-processing quality assurance procedures ensure not only that errors are found and eliminated, but also that workflow processes are improved to prevent further errors.

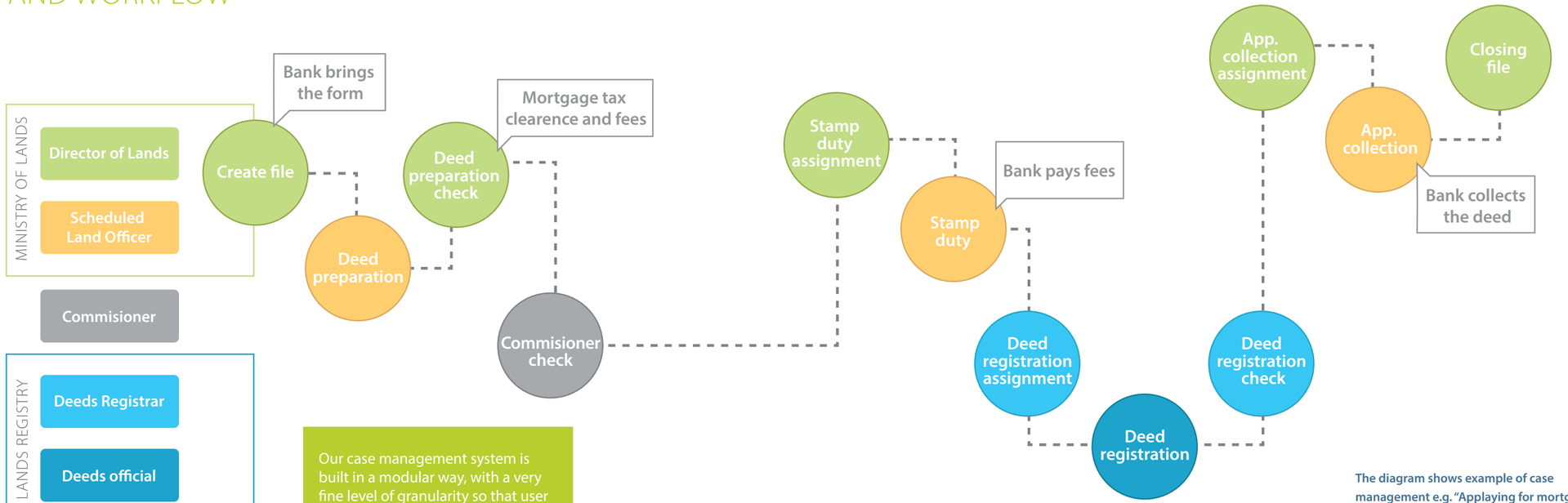


Preview of measured data - borders, location and bearings of imagery

Efficient data entry and basic location measurements using on-board GPS.

5. CASE MANAGEMENT AND WORKFLOW

Case management and workflow are important subsystems in the land administration suite, as they allow each permitted type of user to perform their tasks in a controlled and predictable way, with supervisors able to check and authorize, or demand rework of any part in the flow of registering or valuing property.
For example, issuing Certificates of Occupancy requires the following set of stages: filling the application; paying transaction fees; executing a land survey; double-checking the existing rights of the land; town planning regulations; cadastre works; public announcement; issuing and collecting a deed and so on. Each of these steps is composed of several data entry elements, document uploads, checks, business rules etc. Further, each of these steps can only be executed by a specific group of users (land administration department, Governor, etc.). Since the process can take many days or even weeks, it is necessary to track where the file is at each moment and who is responsible.
To facilitate all these requirements we have established a case management and workflow system which is configurable to every detail - the data entries, business rules, rights, responsibilities and so on.



Our case management system is built in a modular way, with a very fine level of granularity so that user permissions, roles, functions within a case, can all be configured and deployed for maximum flexibility in managing workflows.

The diagram shows example of case management e.g. "Applaying for mortgage" case.

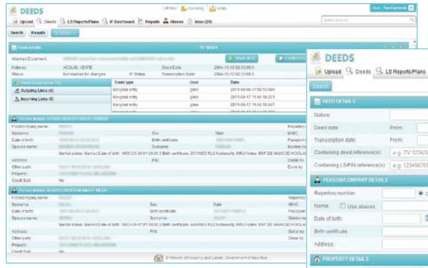
6. REGISTERS OF LEGAL ENTITIES AND RIGHTS

All land administration systems require a register of "legal entities", which could be individuals, groups, or companies - any entity that can own or manage land. Hence our land administration suite contains very effective database tables to manage the unique and definitive definition and identification of legal entities/customers (or parties), whether they be individuals or organizations (e.g. sole-traders, etc.). The customer management subsystem is linked, interoperates and/or takes services from a national customer identification system (several states are building unique ID systems for individuals, and most states have a business registration system - at least regionally, if not nationally).

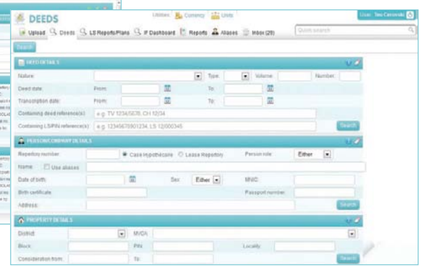
This subsystem therefore includes:

- Links to national ID format and services where these exist.
- Bar-code scanning.
- Use of aliases to support searching and identification of customers through alternative spellings/names.

Each legal entity is linked to land or property through a set of Rights, Restrictions and Responsibilities (RRR Register).



Search form for Deeds



Details about specific deed, related documents, links and meta-data

Our system is designed to make all relevant information immediately accessible to anyone processing a case so that appropriate decisions and authorizations can be made. Examples include:

- The ability to link documents to parcels or other spatial features.
- The ability to show multiple layers simultaneously (easements on parcels, for example).
- The ability to interoperate between systems in different disciplines (e.g. planning and cadastre) and at different government levels (e.g. national and local), for example, to assure proper planning approval is achieved and no planning conditions are broken when land is transacted.

7. REGISTER OF PARCELS, BUILDINGS AND OTHER PHYSICAL OBJECTS

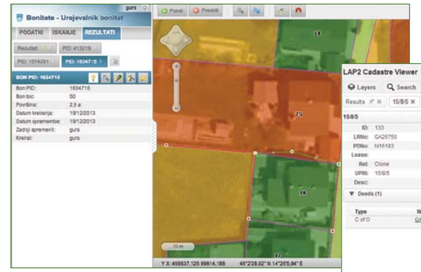
A digital Cadastre Map system, either for land parcels, buildings, streets or other objects, must be up-to-date, effective and accurate, yet easy to use, in order to help users carry out their tasks more efficiently. Due to complexity of spatial data and the relationships between records (e.g. neighborhood parcels, parcels and the buildings on them, etc.) it is not sufficient to simply focus on editing of spatial data (points, lines and polygons) but rather their relations too - thus the need for a topological model.

Cadastral maintenance requires:

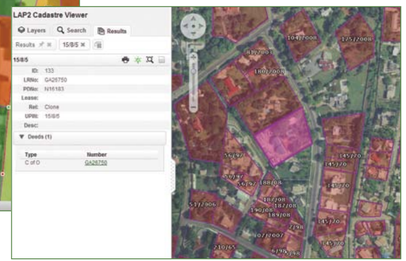
- Creation of cadastral information in a provisional layer with careful checks on topology and consistency with the live active one. Initial editing is done on a provisional layer with undo/redo functionality within a case.
- Linkages with other document types (for example, deeds and land survey reports and plans).
- Careful and secure locking of objects (parcels, parcel edges and the points that comprise these), so that different users' edits do not clash with the ongoing edits made by other users (for example in the case of editing neighboring parcels).
- The possibility to improve accuracy to facilitate the move from indicative to more formal boundary definitions.

There are also some other non-intuitive features of the Register which we find relevant:

- Full object (parcels, buildings, etc.) history (provenance and mutations) is maintained.
- Multiple coordinate conversion is supported.
- Every point, line, parcel has an accuracy standard established according to different rules (e.g. source of information, region, capture method, topography, etc.). The system also supports informative precision-based styling, facilitating systematic improvement as necessary.
- Coordinate geometry (COGO) measurements and inputs are supported.



Topology editing within the browser



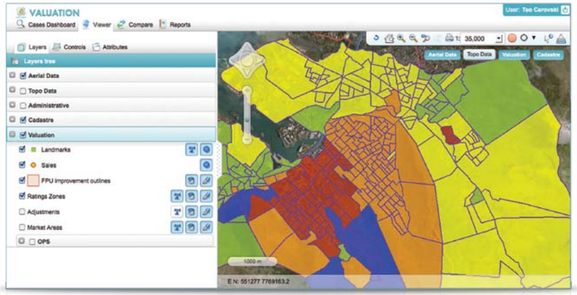
Links from Cadastre Viewer to data from other registers

8. PROPERTY VALUATION AND OTHER REVENUE COLLECTION SOURCES

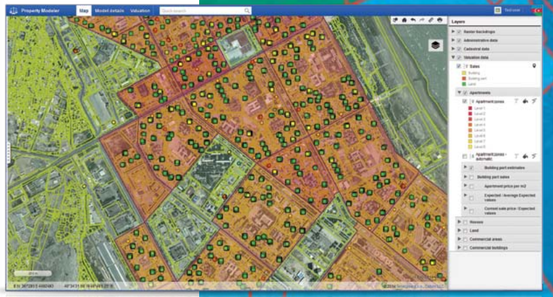
Live capture of title deeds and the location of the sale through the cadastral update allow for near real-time property sales monitoring. Rapid increases or decreases in value can be examined. Sinergise have used national property sales data for the generation of computer aided mass appraisal (CAMA, mass valuation) models, and their update and recalculation where necessary to reflect the actual market value. At the beginning, as live market data is not yet available, we can build valuation models based on back-captured data.

The property valuation system features functionalities such as:

- Market data registry.
- Tools for creating zone value maps and valuation models.
- Tools for mass valuation of real estate properties.



Country map showing areas coloured based on number of sales in specific period



Country map showing areas coloured based on sales statistics

9. URBAN CADASTRE AND MASTER PLAN

Once we have all the standard data and processes in place, we can proceed with activities aimed at formation and utilization of urban cadastre information resources as well as monitoring of the construction objects.

The city-planning cadastre contains information about the terms and conditions of implementation of the city-planning activities at any part of city territory. This information is necessary for investors to evaluate investments and to authorities for taking reasonable administrative decisions, as well as citizens to protect their rights to a favorable environment.

There are several activities supporting local governments to plan the development of urban and rural areas:

- Master Plan.
- Territorial and sectorial schemes.
- City planning schemes.
- Territory planning documentation.
- Construction permits.
- Project documentation.

Several layers of spatial information can support local governments making decisions, relevant for development of urban and rural areas

Benefits for a wide group of users

Public authorities and local autonomous bodies

- For state and municipal control over city development.
- For preparation of bids for the sale of city real estate.
- For public control and supervision over the utilization of land plots.
- For monitoring of city planning objectives.

Investors and developers

- For evaluation of investment potential of city territories and particular objects.
- For evaluation of investment potential of land plots proposed for bids.

Legal persons and individuals

- As initial data for the elaboration of projects of territorial planning, urban zoning, architectural and construction solutions.

Public organizations/associations/unions

- For materialization of the citizens' rights to obtain trustworthy information about development prospects of the city, its particular territories and objects.
- For public control over city planning activity on urban territory.

10. E-GOVERNMENT SERVICES

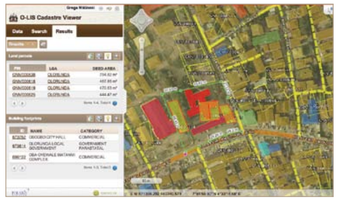
The transparent publishing of official data can contribute to faster development of markets, attracts foreign investors and ensure fair competition.

Cadastre viewer

The cadastre viewer shows official cadastral data. The system is live and the data is visible as soon as all processes have been completed.
The government can decide what data to publish - e.g. private data (ownership) is usually hidden.

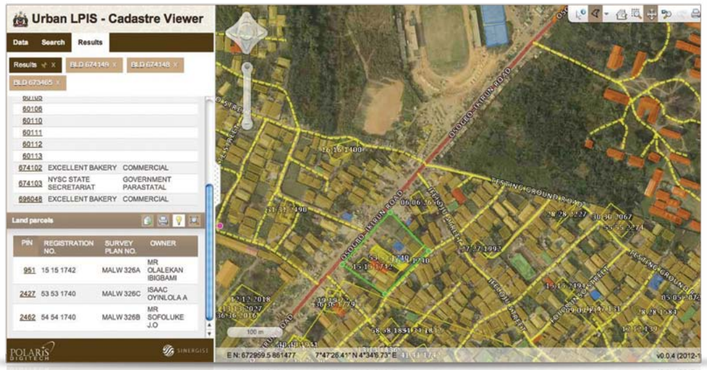
Direct e-services

As well as integrated web applications, we can publish the data also through standardized web services, e.g. WMS and WFS or some customer-specific formats.



Public viewer also supports spatial analytics so that one can analyse all available data in specific location

Mapping output



Spatial analytics are supported (e.g. show all properties within specific area)

11. SUPPORTIVE LAND ADMINISTRATION MODULES

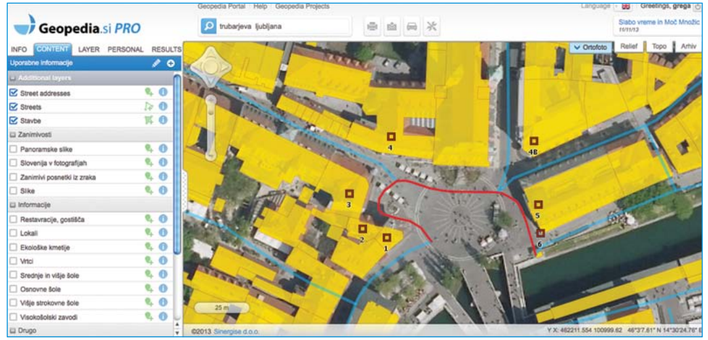
Addressing System

When establishing addressing systems we can assist the numbering of property (e.g. odd and even numbers on the left/right side of streets) with automatic functions.

Address Verification System

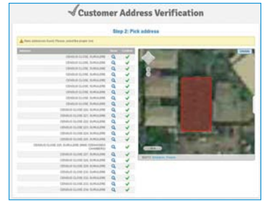
To support the Registration project in Nigeria, where the client needed a way to verify addresses, we developed libraries which can be integrated into 3rd party software:

- JAVA software libraries for integration into the Registration software. Libraries contain encrypted spatial data to be used at desktop computers offline. Libraries allow structured and full-text searches within the address database and verification of existing address.
- JAVA software libraries for integration into an online Registration portal.
- Online applications for searching and verifying of addresses.



In cases of town squares, numbering can follow different rules

Automatic functions ensure standard procedures for numbering of properties (e.g. odd and even numbers on left/right street)



List of addresses fitting criteria

12. TECHNICAL FEATURES

Supporting NSDI through spatial and information services

The web-based, role-based system facilitates the interworking of different users from different departments, effectively sharing each other's spatial (and other) data in a way envisioned by the NSDI concept.

Reporting and Printing

We note the importance of producing maps and reports from the KCLIS integrated system. The Giselle framework has generic functionality to generate tabular/textual reports in at least the following formats: CSV, XML, XLS, and PDF. In some recent systems, for certain aspects (e.g. system generated letters) where the client has required some flexibility, we have generated RTF format output, which allows the users some functionality for editing the pro forma reports generated by the system.

Statistics

The statistics module requires configurability as requirements for new reports are constantly appearing. We have therefore created a module which is completely configurable within the database and presents the results through a simple web user interface. The reports can be either live (produced on request) or preprocessed (e.g. every night) for those requiring many system resources.

Coordinate conversion

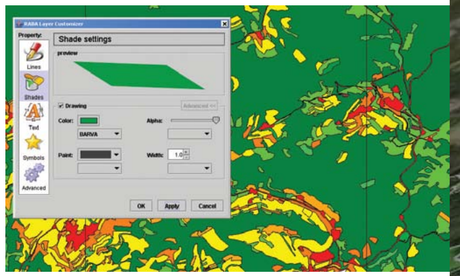
Coordinate conversion is required both while importing data into the system and also during standard operation. It is not uncommon to have several coordinate systems active, thus users need a tool to transform between them.

Data transition tools

We do understand that cadastral processes involve several parties outside of the organization (geodetic personnel, the public etc.) who provide input files in various formats. That is why it is needed to support several types of input files.

Statistical Analysis and Thematic Mapping

Since parcels are stored in a relational database (RDBMS), executing statistical queries on geometries is possible by using simple SQL queries. Our system can use styling properties (i.e. shading colour) directly from the database so thematic mapping is very simple to achieve. This is done by configuring the layer to use a view, which is a join of a parcels table and a classification table. The colour of individual classes is read from the database and retrieved together with the graphical parcel data for rendering. The settings can be controlled using the standard layer properties dialog or the Config Manager application.



Example of thematic mapping: The shading color of the polygon is determined by using the "BARVA" ("COLOR") field in the database, selected from a drop-down list in the dialog box

3D Terrain Modeling

If elevation data (Digital Elevation Model or Digital Terrain Model) is available, it can be used to display a 3D view of a chosen area overlaid with land parcels. This view helps identify areas and boundaries that are not clearly visible in the 2D orthophoto images.

13. SYSTEM ADMINISTRATION

User management and roles

The User Management application is designed to simplify and accelerate the management of users and their assigned permissions, allowed operations as well as group assignments. The application provides a complete toolset for managing these processes and allows for quick and easy editing. Users of this application are also subject to the permissions and operations assigned to them and may not step outside their authority, hence preventing any abuse.

User management tools offer control over the registration of individual users in the system and allows the system administrators to manage custom user groups. The application provides an advanced user interface to deal with common functionalities such as adding new users, adding users to groups and adding operation to users.

Configuration of SDI

System administrators are provided with a tool to add, modify, configure and export layers as needed. "Independent" additional layers -- those that do not need any explicit or enforced topological constraints with other objects that are used in the management of the register (for example utility lines, for mapping easements, proposed roads for identifying compulsory purchases, etc.) -- can be added, ordered and configured (in terms of display) easily through GML modification.

Monitoring tools

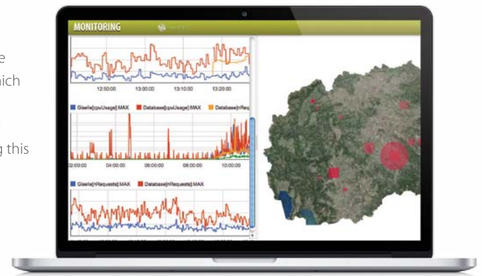
As the process of managing LIS data is highly complex and work intensive, it is essential to reduce any software and hardware issues to the minimum. The system should be operational 24/7.
That is why we developed advanced monitoring tools - they support the discovery of errors in the infrastructure when they occur.

For more efficient work of the support center, we have developed a Server administration tool, which supports administrators to observe users in real-time. Some of the parameters of the system and individual servers which can be monitored using this tool are:

- Database performance.
- CPU consumption.
- Memory consumption.
- Network utilization.
- End client throughput.

Administrator tools also support management of servers, such as:

- Load/manipulate images residing on the image server.
- Monitor distributed servers.
- Manage cached data on distributed servers.
- Schedule updates for data in local offices.



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